OPERATIONALLY ENHANCED BIOREACTOR

[0001] The present invention relates generally to bioreactors through which evaluation of biofilms is enhanced.

STATEMENT OF GOVERNMENT INTEREST

[0002] The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefore.

CROSS-REFERENCE TO RELATED APPLICATION

[0003] This application claims the benefit of U.S. Provisional Application No. 60/465,231 filed April 25, 2003, entitled "OPERATIONALLY ENHANCED BIOREACTOR", incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0004] The structural and functional condition of biofilms is presently studied and evaluated by use of experimental laboratory devices such as bioreactors as generally known in the art. Such bioreactors induce growth of biofilm therein on glass microscope slides from which the biofilm is collected on glass beads subject to aeration within a testing chamber for experimental evaluation purposes. However, various problems heretofore arose with respect to such use of bioreactors involving poor aeration during the biofilm growth process and difficulty in selective removal of microscope slides without disruption of biofilm growth on the slides and collection thereof on the glass beads.

SUMMARY OF THE INVENTION

[0005] Pursuant to the present invention the housing of a bioreactor has several ports for aeration of biofilm coated glass beads deposited therewithin, to supply nutrients and liquid thereto, and to allow outflow from the housing chamber. Microscope slides on which biofilm growth occurs are located within the bioreactor housing from which a microscope side is slidably withdrawn from the open end of the bioreactor housing by removing a holder holding the slide or by forceps to avoid biofilm disruption caused by withdrawal. A relatively high length to width dimensional ratio for the bioreactor housing is provided, such as 7:1, so as to ensure complete aeration within the bioreactor housing chamber during biofilm growth.

BRIEF DESCRIPTION OF DRAWING

[0006] A more complete appreciation of the invention and many of its attendant advantages will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

[0007] FIG. 1 is a side elevation view of a biofilm testing bioreactor, in accordance with one embodiment of the present invention;

[0008] FIG. 2 is an enlarged partial section view taken substantially through a plane indicated by section line 2-2 is in FIG. 1;

[0009] FIG. 3 is a traverse section view taken substantially through a plane indicated by section line 3-3 in FIG. 2;

[0010] FIG. 4 is a partial section view taken substantially through a plane indicated by section line 4-4 in FIG. 3;

[0011] FIG. 5 is a side elevation view of another embodiment of the present invention with respect to the biofilm testing bioreactor; and

[0012] FIG. 6 is a transverse section view taken substantially through a plane indicated by section line 6-6 in FIG. 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0013] Referring now to the drawing in detail, FIGS. 1 and 2 illustrate a bioreactor 10 having a vertically elongated housing 11 which includes an upper sealable top end portion 12 from which insertable retraction rods, actuating means, 14 may project. An upper housing section 16 of the housing 11 which can be of a smaller diameter than the top end portion 12 extends downwardly therefrom. The upper housing section 16 has an outlet port 18 connected thereto. From the upper housing section 16, a cross-sectionally mid-housing section 20 further extends downwardly to a lower housing section 22 of smaller diameter, closed at its bottom end to form a testing chamber 24 within the bioreactor housing 11 having internally threaded inlet ports 26, 28 and 30. Aeration inflow 34 and nutrient infeed supply 36 to the testing chamber 24 of the housing are respectively delivered thereto through the ports 26 and 30 as shown in FIG. 1.

[0014] As shown in FIGS. 2, 3 and 4, a plurality of glass slides 42 are positioned in the mid-housing section 20 above the lower housing section 22 by retention within a holder 44 having a bottom 46 within which an opening 48 is formed, through which upflow of feed fluid and aeration is conducted between the slides 42 from the lower housing section 22 and testing chamber within which glass beads 50 are deposited to fill the lower housing section 22, up to the lower portion of the mid-housing section 20.

[0015] The slide holder 44 with the slides 42 therein may be retracted upwardly from the mid-housing section 20 for removal from the bioreactor 10 through its top end portion 12 by means of the rod(s) 14. At least one rod 14, metal, plastic, glass or the like, is accordingly provided with a threaded end 52, threadedly inserted into the bottom 46 of the holder 44 as shown in FIG. 4.

[0016] It will be apparent from the foregoing description, that beneficial location of the aeration inlet port, the feed supply port, and the possible testing port 26, 28, 30 to the testing chamber portion 24 of the bioreactor housing 11 enhances aeration fluid flow and testing. Also, removal and replacement of the slides 42 is enhanced by the holder 44 with the rod(s) 14 connected thereto, in an arrangement which accommodates a housing configuration providing a large length to width ratio of 10:1 to 5:1, preferably 7:1, in order to achieve increased aeration. Furthermore, the bioreactor arrangement as previously described provides for a relatively high ratio (above 10 square centimeters per milliliter) for internal surface area in the housing chamber 32 on the slides 42 and the beads 50, to the volume of the infeed liquid being processed. Housing chamber 32 includes 24, 22, 20 and up-to outlet port 18 of 16.

[0017] Referring now to FIGS. 5 and 6, a bioreactor 10' in accordance with another embodiment of the present invention is illustrated. The bioreactor 10' has a vertically elongated housing 11' which includes the aforementioned lower housing section 22 with the closed testing chamber 24 and the three ports 26, 28 and 30. The rest of the housing 11' is formed by a cross-sectionally contoured mid-housing section 20' extending from the lower housing section 22 to the upper sealable top end portion 12 just above the outlet port 18. The mid-housing section 20' has fixedly mounted on opposite sides walls 52 thereof adjacent the lower section 22 a plurality of closely spaced guide rods 54 above a neck 55 between the housing sections 20' and 22 as shown in FIG. 6. The aforementioned glass slides 42 are accordingly manually positioned and removed from within the mid-housing section 20' above the collection of deposited beads 50 in the lower housing section 22 between the guide rods 54 by insertion into the housing 11' through the open end of the sealable top portion 12, using tweezers (not shown).

[0018] Obviously, other modifications and variations of the present invention may be possible in light of the foregoing teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is: